

Title: On the long time regularity of the Shallow Water equations

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Abstract: We study the long time existence of classical solutions to the Shallow Water (SW) equations with pressure gradient and rotational forcing that are both singular within certain scaling regime of the Froude and Rossby numbers. The SW dynamics is then shown to be asymptotically close to the one governed by the 2-D “pressureless” rotational Euler equations with sub-critical initial data, which in turn yields the increasingly long time existence at this singular regime. The novelty of our approach is the use of an approximate system that is linear while still capturing both the singularity and the advection dynamics of the underlying nonlinear system. The near periodic dynamics shown here is closely related to the circular fluid motions observed in geophysical sciences.